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ABSTRACT

A theoretical taxonomy of student outcomes based on the National Center for Higher Education Management Systems' (NCHEMS) structure was investigated using survey responses from 1,833 alumni of a comprehensive state university. The alumni spanned 45 class years and four major curricular types: applied science, business, engineering, and qualitative studies. Alumni were asked to comment on 16 possible educational outcomes extracted from the writings of Oscar Lenning and Howard Bowen. The loadings of the 16 outcomes were subjected to a varimax rotation. The following six factors were retained that supported the work by NCHEMS: personal growth, job skills, cultural awareness, general knowledge, academic skills, and human relations skills. The findings tend to track the taxonomy proposed by Lenning except for the splitting of his category of the social/cultural/personal area into the three dimensions of personal growth, cultural awareness, and human relations. The findings do not support Lenning's more refined four-digit taxonomy that has five dimensions and groups items into two-digit subcategories within each dimension (a procedure similar to the structure of the Higher Education General Information Survey). It was found that outcomes of the university have changed in a smooth continuous fashion over the 40 years. Additionally, different curricula have produced different outcomes, a finding that adds some support to the viewpoint that certain types of people self-select into specific career fields. (SW)

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Alumni Perceptions: A Test of NCHEMS' Outcomes Structure

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Alumni Perceptions: A Test of NCHEMS' Outcomes Structure

Abstract

A theoretical taxonomy of student outcomes from NCHEMS is investigated using responses from 1,833 alumni of a comprehensive state university. The alumni spanned 45 class years and four major curricular types. Six factors were retained which supported the work by NCHEMS while demonstrating a needed refinement in the social/cultural/personal area. MANOVA showed great stability of outcomes with no significant time X curriculum interaction. There were smooth trends on two significant discriminant functions for the effect of time. Two significant discriminant functions for curricula showed that those in various fields felt they received relatively more benefits in expected areas.

Alumni Perceptions: A Test of NCHEMS' Outcomes Structure

Students, parents, faculty, legislators--such groups have concerns over the impact of an institution of higher education on its students. Frequently the pressure to study the products of education comes from the public "because public disaffection with them {colleges} is growing. . . . In addition the return on their investment is being questioned." (Lenning, 1976, p. vii) Bowen supports a strategy of defending higher education by documenting work on the outcomes of higher education, both financial and nonfinancial (1977). The pressure to investigate outcomes also can be found within the collegium. Baird (1976) views the measurement of outcomes as a principal step in changing the environment of an institution. Palola and Lehmann (1976) include the measurement of outcomes as one of the five components in a planning framework called PERC (Program Effectiveness).[1]

Trying to determine the effects of attending and studying in a university setting is difficult--after all a long period of time is involved and it is hard to control for intervening variables, maturation, or other factors which would allow the use of a classic research design. As a result of these difficulties, the present study does not attempt to "prove" anything in the classical sense, it seeks to give some base line information on how alumni perceive their college experience. In addition, an opportunity existed to evaluate a taxonomy of four types of functional outcomes discussed by Lenning (1977, p. 18): Economic; Educational/Technological; Political; and Social/Cultural/Personal. Lenning, after additional review, developed "type-

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[1]Unfortunately, the regional accreditation agencies seem to lack this growing concern for educational outcomes. For example, see Trout (1981, p. 47) who notes that "concerns about the outcomes of the educational process generally appear only as appendages to accreditation standards."

of-outcome subcategories" which replaced his first taxonomy with indicators of outcomes falling into these categories: Economic; Human Characteristics; Knowledge, Technology, and Art Form; Resources and Service Provision; and Other Maintenance and Change Outcomes. These later five dimensions have a four-digit identifier and are proposed as outcome categories to replace his original taxonomy. Consequently, an opportunity existed to assess the outlook and outcomes of the alumni of a university and to review the outcomes structure proposed by Lenning.

Procedure

The investigation of outcomes, therefore, became a part of a much larger opinion survey of 4,082 former students using subsamples of classes at every fifth year from 1931 to 1976. The subsamples were the smaller of a random sample of 500 or the total graduating class. Only alumni were surveyed for whom there was a mailing address.

For the purpose of analyses, respondents were divided into curricular groups: applied science (agriculture, architecture, biology, computer science, mathematical sciences, and natural sciences), business, engineering, or qualitative studies.[2] Class year served as another grouping over time or by graduation group. Group 1 (1931-1946), Group 2 (1951-1956), Group 3 (1961), Group 4 (1966-1971) and Group 5 (1976). These classifications coincided with certain historial events: WW II era (Group 1), the Korean War era (Group 2), the growth of the institution {movement away from a polytechnic institution} (Group 3), emergence as a university (Group 4), and university status (Group 5).

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[2]These groupings were selected to be similar to those established by Biglan (1973) but were brought to a higher level of aggregation to give a more balanced cell size over the time covered by the alumni surveyed.

In the questionnaire alumni were asked to comment on sixteen possible educational outcomes which had been extracted from the writings of Lenning (1976, 1977) and Bowen (1977). The sixteen outcomes appear in Table 1.

Table 1 about here

Responses of the alumni to the outcomes were factor analyzed. This technique allowed for development of dimension scores to test the trends over time, the differences by curricula group, and the possible interaction of curricula group over the time groups. Since such methodology traditionally produces correlated measures, the test for differences was undertaken using multivariate analysis of variance with discriminant analysis on the dispersion matrix for each treatment tested (Clyde, 1969).

Intercorrelations between the items were computed and principal components were extracted. The eigenvalues indicated the possible use of a 5, 6, or 7 factor solution (values of .81, .77 and .72 respectively, accounting for 66%, 71%, and 75% of the cumulative variance). This finding caused varimax rotations to be performed, and the 6 factor solution was selected because of the relative drop in eigenvalues, the satisfactory communalities (maximum of .85, minimum of .60, with a median of .70), and the degree to which simple structure was obtained after rotation.[3]

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[3]The five factor solution had a median communality of .66 but had numerous overlapping items for both orthogonal and oblique (Promax) rotations. The seven factor solution had a median communality of .71 and was similar to the six factor solution with an additional factor which was a doublet formed by the two items which contained the word "clarification."

Findings

The loadings of the sixteen outcomes after a varimax rotation for six factors are shown in Table 1. Dimension scores are formed as average item scores using the items as noted in Table 1. The means for the six dimensions are shown by Curriculum Group (Table 2) and by Graduation Group (Table 3).

Tables 2 and 3 about here

There proved to be a lack of significant interaction between Curriculum and Graduation Group ($F = 1.181$, $df = 72, 8896$; $p > .1$) based on the scores on these six dimensions. Significant differences exist between the various combinations of the Graduation Groups ($F = 6.82$, $df = 24, 5701$; $p < .001$) and also Curriculum Groups ($F = 19.74$, $df = 18,4622$; $p < .001$). The standardized discriminant function coefficients for the significant functions from both analyses are shown in Table 4. The centroids for the graduation groups are shown in Table 5. The centroids for the curriculum groups are shown in Table 6.

Tables 4, 5, and 6 about here

Discussion

While the factor analysis was performed more for a reduction of items to constructs than as a confirmatory analysis, the results were similar to outcomes which one might expect from prior research in postsecondary education. The findings tended to track the taxonomy proposed by Lenning (1977) except for the splitting of his category of the Social/Cultural/

Personal Area into the three dimensions of Personal Growth, Cultural Awareness, and Human Relations Skills. These findings, however, do not support Lenning's more refined four-digit taxonomy which has five dimensions and which groups items into two-digit subcategories within each dimension (a procedure similar to the structure of HEGIS). When one translates our 16 items into Lenning's four-digit category code numbers, we failed to obtain loadings on the factors which imply homogeneous items (e.g., items with the same first two digits). The failure to obtain factors which support the concept of homogeneous two-digit outcome codes is illustrated by several examples. While Lenning refers to 22XX as Competence and Skills, one of our items in this category, Handle Various Situations, loaded on our Personal Growth dimension. Our items on job skills, both part of Lenning's 22XX category, became a separate dimension. Our items on Leadership Ability and Communication Skills (also in 22XX) loaded on the dimension of Human Relations Skills. Stated another way, we found at least three different dimensions which had loadings from items in the 22XX or Competence and Skills outcomes. Moreover, our item of Social Awareness, which appears similar to Perception of Others or 2430, loaded with our item of Appreciate Arts, which appears similar to Feelings and Emotions or 2330, to form the dimension of Cultural Awareness, rather than joining with the two items related to Perception of Self. These two items, Self Acceptance and Clarification of Values, loaded on the dimension of Personal Growth.

The results also suggest conclusions one might derive in considering the Clark and Trow (1966) topology: The Personal Growth dimension found in this research appears similar to the focus of the Nonconformist; Job Skills is analogous to the Vocational; Academic Skills ties to their Academic; and Human

Relations Skills corresponds to their Collegiate. The presence of such correspondence as found in the present study indirectly supports the Clark and Trow topology since their types could have caused the emergence of these dimensions.[4]

The dimension identified in this research as General Knowledge may have been misnamed by the researchers, for the loadings from "handle various situations" and from "communicate" imply the underlying construct was one of being prepared for the uncertainty one faces after leaving college. Since items written to reflect what might be called general ability were not included in this research, findings concerning a General Knowledge construct must await further research.

The MANOVA analysis, among other things, showed a lack of significant interaction between Graduation Group and Curricula. The lack of significance suggests that the relative amount of the outcomes, as reflected in the major of students, remained stable over time. This finding means that the difference in amount of an outcome received by one curriculum group relative to another curriculum group stays essentially the same over time. On the other hand it also means that the shifts in an outcome attributable to time occur proportionally to all groups. Three dimensions from the MANOVA explain the dispersion of groups based on their time of graduation.

The first dimension, TI, relates to the applied nature of the outcome with the directly applicable outcomes of Human Relations Skills having a strong positive loading (.677) and the broader less applied outcome of Cultural Awareness having a high negative weight (-.929). Within the

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[4] For example, if these groups were present and every one except the collegiate group rated the items in Human Relations low and the collegiate group rated all of the other items low while giving these items a high rating, the items would be correlated and most likely emerge as a factor.

Graduation Group, on this dimension, the means progress steadily from a positive score for the earlier groups to a negative mean for the most recent group (-.526 for Class of 1976). This result is extremely consistent with the shift of emphasis from that of a technical institute to that of a comprehensive university.

The second dimension (TII) is more difficult to interpret but seems to reflect the amount of interpersonal (Human Relations) skills one received relative to specific job skills. The most reasonable explanation for the curvilinear shape of group means over time comes from attributing the dip in scores to societal emphasis on technology with the most negative score coming near the time of the successful Sputnik program (1957) and the emphasis on science and technology this space achievement caused in the United States.

The third dimension (TIII) seems to relate to the way in which one handles challenges with a positive loading from Personal Growth (.996) to a negative loading on Human Relations Skills (-.850). While it is not fully understood why two groups have positive means on this dimension, it is interesting to note the fact that these two groups roughly coincide with the two major "police actions" in Korea and Vietnam.

In terms of Curriculum Groups, the first function (CI) represents the relevance of the outcomes to job skills with that dimension having a negative weight (-.650) and Cultural Awareness having a positive weight (.648). Business and Qualitative Studies, where one develops more general skills, have positive means while Engineering has a negative mean (-.620). The second function (CII) represents a contrast between the development of further skills (Academic: -.867) versus the direct movement into society (Human Relations: .544), and differentiates between Business at the positive end (.280) and Applied Science at the negative end (-.143).

The most obvious point here is that the relative amount of the outcomes essentially support the traditional wisdom of what those in the various curricula seek in an education (and need in a career): the engineer seeks technical skills, the major in applied science is oriented toward graduate education, and the business major needs to be able to "work with people." As in the earlier case we can not prove that the perceptions of these graduates represent reality, yet the results support a belief that the institution is meeting the unique needs of a diverse student body.

Conclusions

The results of the study have several implications. While Lenning has four types of functional outcomes in the original taxonomy, the set of 16 outcomes in this study support three separate constructs in the area of personal development outcomes: Personal Growth, Cultural Awareness, and Human Relations Skills. Otherwise the taxonomy appears functional. The divergence from Lenning's five "type-of-outcome subcategories," however, is extensive. The dimensions in this research, for the most part, would not load into such a taxonomy. Our results fail to support the four-digit subcategories proposed. Perhaps this lack of agreement develops from the large number of "Human Characteristics Outcomes" included in this study. The variances over curricula and over time also influenced what emerged as dimensions. The empirical results from this study do not diminish the value of using the outcomes structure to suggest specific items for investigation, but researchers should be extremely cautious in assuming that the outcomes are homogeneous in the "type-of-outcome subcategories."

Furthermore, there is a possibility that a flexibility appropriate for coping with uncertainty is another dimension of outcomes. Future research

should test this possibility by including additional items which would load on this dimension if it is present.

It appears that despite dire warnings by Lenning the outcomes of at least this institution have changed in a smooth continuous fashion over a span of forty years, a finding which implies a type of evolutionary behavior which may be of use in anticipating the future. Another finding is that different curricula produce different outcomes, an event which does not interact with year of graduation class and a fact which adds some support to the viewpoint that certain types of people self-select into specific career fields.

A final point appears to be of importance for studying outcomes. Alumni seem to say that the outcome of their stay in the university has been rewarding and has influenced their careers and approaches to life. Regardless of the correctness of such a perception, studies on alumni may be of use simply to inform the management and financiers of a university what alumni think of the results of a college education and to provide public relations materials to use with various publics.

Table 1

Varimax Rotated Factor Matrix
for Sixteen Educational Outcomes

Outcomes	Personal Growth	Job Skills	Cultural Awareness	General Knowledge	Academic Skills	Human Relations Skills
Background for further education	.060	.236	.100	-.023	.883*	.002
General knowledge	.108	.185	.238	.857*	-.063	.105
Skill for first job	.062	.738*	-.195	-.002	.249	.060
Skill for current job	.084	.809*	.094	.166	.037	.019
Clarification of life goals	.475*	.368	.457	.044	.070	.221
Leadership ability	.293	.185	.077	-.040	-.017	.760*
Social awareness	.140	-.042	.670*	.169	-.124	.417
Personal development	.303	.066	.351	.094	-.018	.690*
Relate to others socially	.267	-.037	.331	.064	-.032	.723*
Appreciate arts	.169	-.082	.753*	.120	.243	.083
Increased ambition	.679*	.128	.126	.137	.202	.220
Handle various situations	.520*	.026	.090	.428	.193	.457
Communicate	.324	-.042	-.021	.377	.155	.626*
Self acceptance	.697*	-.030	.168	.128	-.024	.391
Clarification of values	.744*	.043	.358	.022	-.080	.233
Accept responsibility for future	.811*	.098	.032	.050	.024	.222

*Used in the equation to develop a dimension score.

Table 2

Educational Outcomes on Six Dimensions
by Curriculum Group*

Curriculum Group	(N)	Personal Growth	Job Skills	Cultural Awareness	General Knowledge	Academic Skills	Human Relations Skills
Applied Science	367	3.36	3.53	2.77	3.74	3.58	3.42
Business	298	3.39	3.34	2.78	3.74	2.99	3.60
Qualitative Studies	235	3.44	3.39	3.07	3.08	3.46	3.62
Engineering	759	3.25	3.90	2.34	3.62	3.57	3.25

*Extent to which experience at institution provided for outcomes: None = 1, a small amount = 2, a moderate amount = 3, a large amount = 4, a very large amount = 5 (average item score).

Table 3

Educational Outcomes on Six Dimensions
by Graduation Group*

Graduation Group	(N)	Personal Growth	Job Skills	Cultural Awareness	General Knowledge	Academic Skills	Human Relations Skills
Group 1 (1931-46)	318	3.42	3.75	2.49	3.69	3.52	3.56
Group 2 (1951-56)	495	3.39	3.77	2.52	3.69	3.33	3.41
Group 3 (1961)	245	3.19	3.62	2.43	3.65	3.34	3.27
Group 4 (1966-71)	426	3.23	3.52	2.73	3.67	3.52	3.33
Group 5 (1976)	175	3.40	3.45	3.10	3.86	3.66	3.44

*Extent to which experience at institution provided for outcomes: None = 1, a small amount = 2, a moderate amount = 3, a large amount = 4, a very large amount = 5 (average item score).

Table 4

Standardized Discriminant Function Coefficients
for Graduation Group and Curriculum*

Dimension	Graduation Group TI	TII	TIII	Curriculum Group CI	CII
Personal Growth	.310	.051	.996	-.217	.002
Job Skills	.299	-.252	.326	-.650	.066
Cultural Awareness	-.929	.174	.401	.648	-.582
General Knowledge	-.146	.028	.142	.107	-.046
Academic Skills	-.440	.474	-.491	-.106	-.867
Human Relations Skills	.677	.723	-.850	.362	.544

*All functions are significant at $p < .01$

Table 5

Centroid Scores for Graduation Groups
on Three Significant Functions

	Functions		
Graduation Group	TI	TII	TIII
Group 1 (1931-1946)	.352	.163	-.131
Group 2 (1951-1956)	.269	-.064	.148
Group 3 (1961)	.144	-.186	-.105
Group 4 (1966-1971)	-.239	-.057	-.075
Group 5 (1976)	-.526	.144	.163
F ($p < .01$)	6.82	3.00	2.69

Table 6

Centroid Scores for Curriculum Groups
on Two Significant Functions

	Functions	
Curriculum Group	CI	CII
Applied Science	.040	-.143
Business	.307	.280
Qualitative Studies	.273	-.068
Engineering	-.620	-.069
F ($p < .01$)	19.74	5.58

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